Use Sign Language Detection: Enabling Communication for the Hearing Impaired

This presentation explores the technology behind sign language detection, its applications, and its potential to bridge the communication gap between the deaf community and non-signers.

Problem Statement

Sign Language Communication Barrier:

- Many individuals who are deaf or hard of hearing rely on sign language for communication. However, there is often a communication gap between sign language users and non-users due to the lack of real-time interpretation systems.

Key Issues:

1. **Communication Gap:**
   - Difficulty in real-time communication between sign language users and those unfamiliar with ASL.
   - Leads to social and professional isolation for deaf and hard-of-hearing individuals.

1. **Limited Awareness:**
   - General public's lack of awareness or understanding of ASL.
   - Reduces opportunities for inclusion and collaboration in various environments (schools, workplaces, public spaces).

3. **Lack of Real-Time Translation:**
   - Current methods rely on human interpreters or text input, which are slow, expensive, or unavailable in many situations.

Urgent Need for a Solution:

- **Real-Time Translation and Communication:**: There is a critical need for an automated system that can detect and translate ASL (American Sign Language) into spoken language or text in real-time. This will enable deaf or hard-of-hearing individuals to communicate seamlessly with non-signers without the need for human interpreters.
- **Increased Accessibility and Inclusion**: An effective solution will bridge the communication gap, promoting inclusivity in public spaces, educational institutions, workplaces, and healthcare settings, ensuring equal participation opportunities for everyone.

Proposed Solution:

AI-Powered Sign Language Detection System:

1. Real-Time Sign Language Detection:
Implementing an AI-based system using advanced deep learning models (e.g., CNN or YOLO) to detect and recognize ASL gestures in real-time through cameras placed in public spaces, classrooms, or meeting rooms.

2. Immediate Text or Speech Conversion:
The system translates ASL gestures into spoken words or text, ensuring smooth communication for both signers and non-signers. The output can be displayed on mobile apps, digital screens, or smart devices for real-time responses.

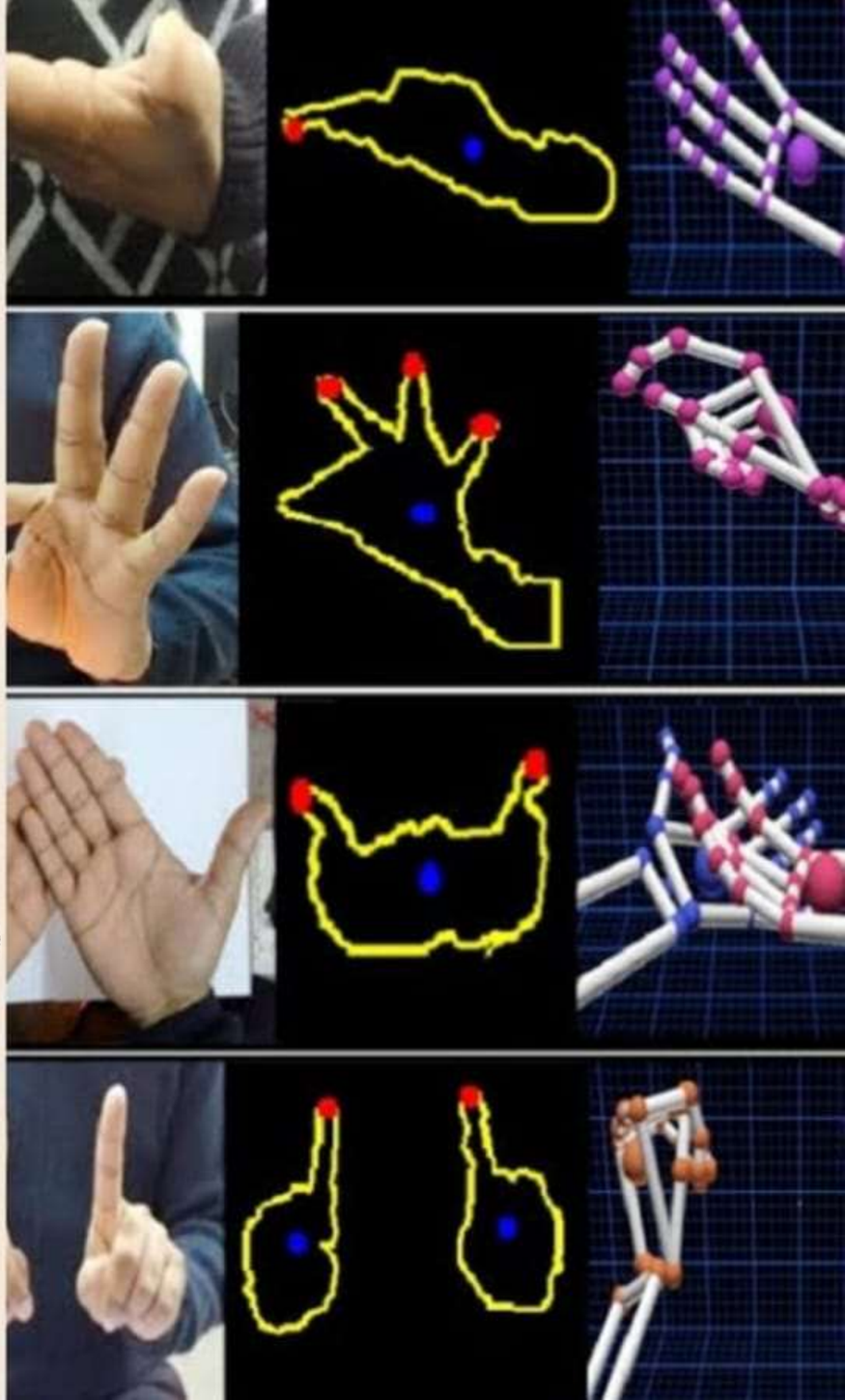
3. Enhanced Accessibility in Public Spaces:
The system facilitates better inclusion in public places, educational institutions, healthcare facilities, and workplaces by removing communication barriers for the deaf and hard-of-hearing community.

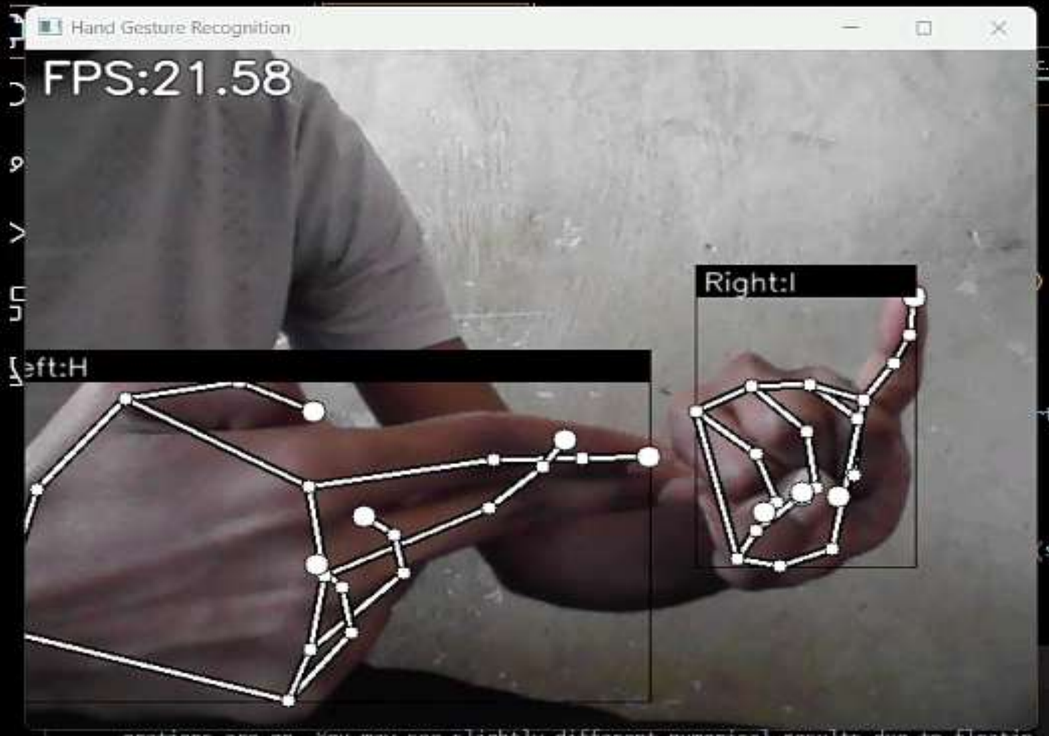
4. Data Collection and Analysis for Improvements:
The system gathers data on common gestures, language variations, and sign usage patterns, which can be analyzed to improve recognition accuracy, adapt to regional ASL dialects, and enhance the learning process for both AI and users.

5. Scalable and Adaptable:
The system can be adapted to various environments and languages, supporting other forms of sign language (e.g., British Sign Language). It can be scaled for use in different industries or tailored for educational and healthcare purposes.

6. Integration with Existing Systems:
The system can integrate with existing communication devices, such as smartphones, laptops, or digital signboards, reducing the need for additional equipment or costly infrastructure upgrades.

7. Cost-Effective and Efficient:
By automating sign language recognition, the system reduces the need for human interpreters in day-to-day interactions. The use of accurate AI models ensures fewer errors, faster translation times, and improved accessibility at a lower cost..



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Impact

- **Commercial**:
  - Reduces communication-related service costs by automating real-time ASL translation.
  - Enhances customer service in retail, banking, and public sectors by supporting deaf and hard-of-hearing customers.

Environment:
- Encourages further innovation in AI and human-computer interaction to refine real-time sign language translation technology.
- Supports integration with smart devices (e.g., smartphones, wearables) for broader and more accessible adoption.

- **Safety**:
  - Enables safe communication in critical scenarios such as emergencies and healthcare consultations.
  - Provides autonomy to deaf individuals in navigating public spaces, offices, and transportation hubs.

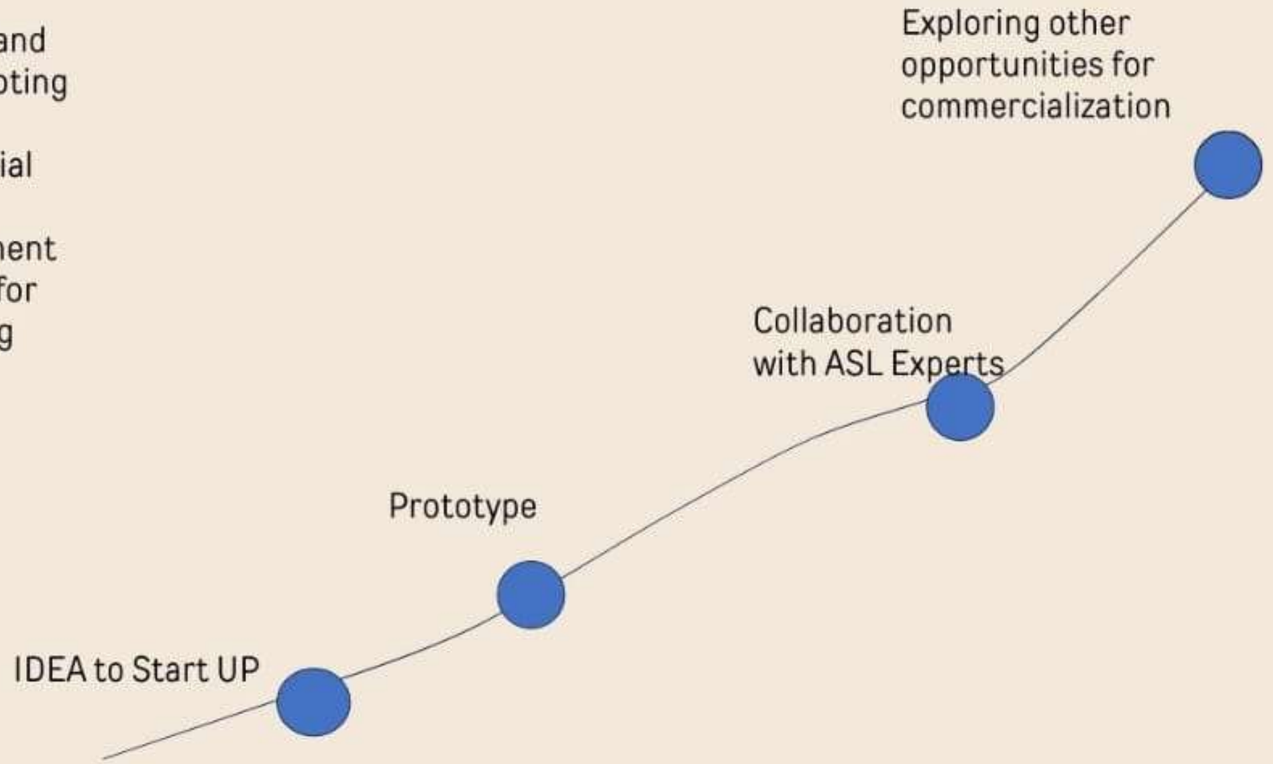
Society:
- Increases public awareness and understanding of ASL, promoting empathy and inclusivity in schools, workplaces, and social gatherings.
- Fosters community engagement and reduces social isolation for the deaf and hard-of-hearing population.

Prototype –Next Step-Commercialize

Next Step :Working with linguistic experts and signers to refine and expand the gesture database.

Explore other opportunities Adoption

Automotive:



Introduction to American Sign Language (ASL)

Visual Language

ASL is a complete language, relying on hand gestures, facial expressions, and body language to convey meaning.

Unique Grammar

ASL has its own grammatical structure, distinct from spoken English, with spatial elements and verb conjugation using handshapes.

Real-Time ASL Detection and Demo

1

Input Capture

Live video feed is captured from a camera or webcam.

2

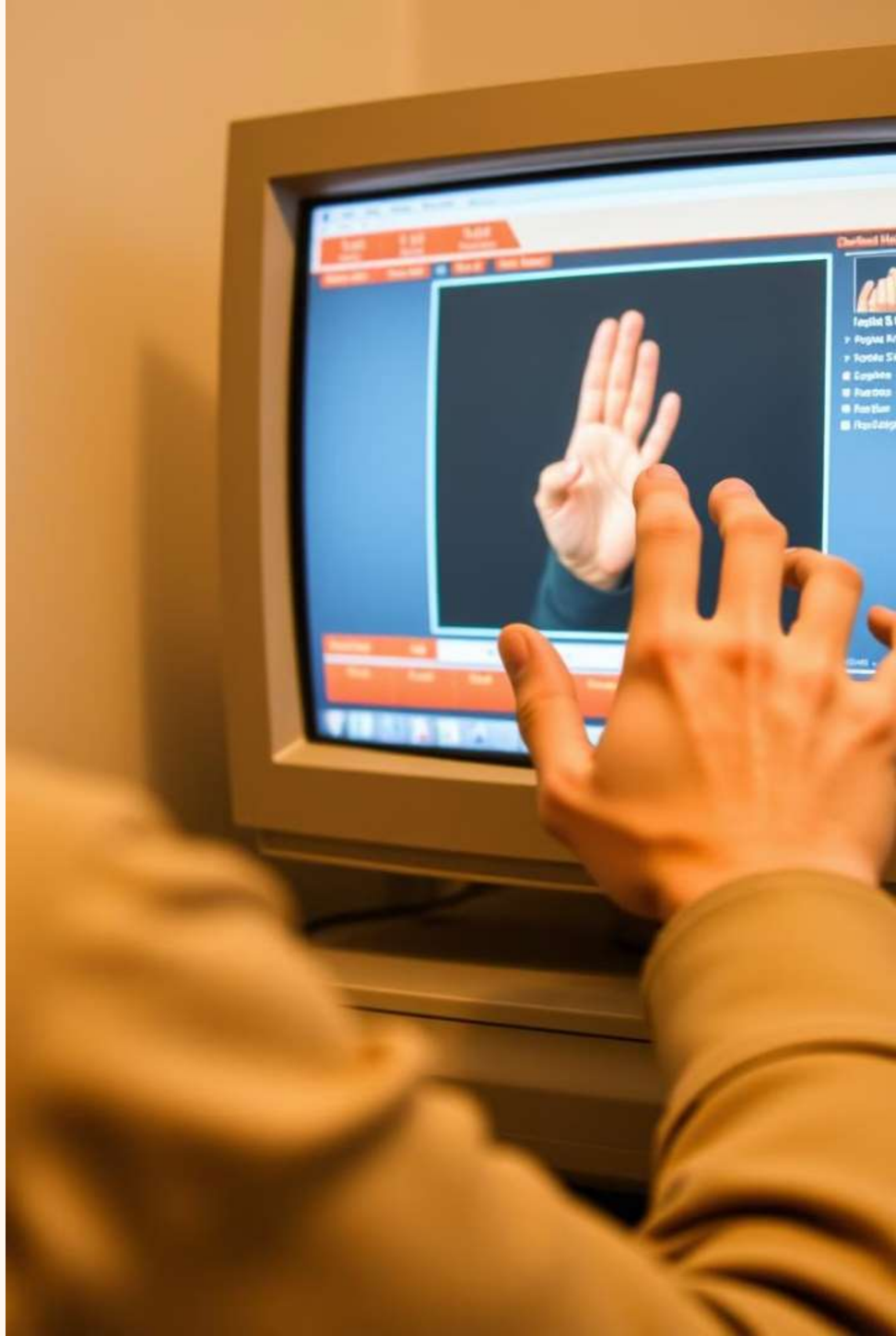
Sign Recognition

The trained model analyzes the video stream, identifying and classifying signs.

3

Output Display

The system provides real-time feedback, displaying recognized signs or translating them into text.



Global Perspective

Hearing Impairment Statistics:
Over 1.5 billion people worldwide experience some degree of hearing loss; among them, approximately 430 million have disabling hearing loss requiring rehabilitation. Projections indicate that by 2050, over 700 million people will have disabling hearing loss.

Indian Context
Hearing Impairment Statistics:
In India, approximately 63 million people suffer from significant auditory impairment, constituting about 6.3% of the population.

Market Size:
The global language translation device market is valued at approximately USD 1.49 billion in 2024 and is projected to reach around USD 4.02 billion by 2034, growing at a compound annual growth rate (CAGR) of 10.42%. Specifically, the sign language interpretation services market is estimated to be worth USD 0.76 billion in 2024, with expectations to grow to USD 1.63 billion by 2033, reflecting a CAGR of 8.5%.

Potential Impact of the Wearable Sign Language Detection Device

Introducing a wearable device capable of translating sign language into audible speech could

:Enhance Communication: Facilitate real-time, offline interactions between sign language users and non-signers, bridging communication gaps.

Improve Accessibility: Provide an affordable and portable solution, increasing accessibility in education, employment, and public services.

Promote Inclusivity: Encourage social inclusion by enabling seamless interactions between deaf individuals and the broader community.

Existing Competition and Pricing

Several products aim to translate sign language into text or speech:

SR Robotics Sign Language Glove:

Description: An Arduino Nano-based glove designed to translate sign language gestures into text or speech.

Price: Originally priced at ₹7,000, currently available for ₹4,999.

Low-Cost Smart Glove by UC San Diego Engineers:

Description: A prototype developed using stretchable and printable electronics, capable of translating the American Sign Language alphabet and controlling virtual objects.

Cost: Built for less than $100.

Challenges and Future Improvements

1

Data Variety

Acquiring a large and diverse dataset encompassing all ASL signs is challenging.

2

Real-Time Performance

Ensuring fast and accurate detection in real-time requires optimization for efficiency.

3

Sign Ambiguity

Distinguishing between similar signs or interpreting complex expressions presents challenges.

References:

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Thank you for your time and consideration.

We appreciate your interest in our sign language detection system and look forward to future collaborations.

Name of students:

Sourav Bhongade
Prajyot Gongale
Dip Agade
Ankush Nivalkar